April 9, 2019

Via ECFS
Marlene H. Dortch, Secretary
Federal Communications Commission
445 Twelfth Street, SW
Washington, DC 20554

Subject: *MOS Testing for High-Latency Bidders (WC Docket No. 10-90)*

Dear Ms. Dortch:

On Friday, April 5, 2019, Hughes Network Systems, LLC ("Hughes") met with Suzanne Yellen, Cathy Zima, Alec MacDonell, and Stephen Wang from the Wireline Competition Bureau to discuss approaches for prospective improvements to the Commission's rules for ensuring that high-latency bidders in future universal service support auctions demonstrate that they are providing high-quality voice service.[1] Hughes was represented at the meeting by Patrick Fisher, Bob Kepley, Udaya Bhaskar and the undersigned. In the meeting, our presentation followed the attached slides, which were distributed to the attendees.

Please direct any questions regarding this filing to the undersigned.

Sincerely,

/s/
Jennifer A. Manner
Senior Vice President, Regulatory Affairs

cc: Suzanne Yellen
Cathy Zima
Alec MacDonell
Stephen Wang

[1] Requirements in place at the time of prior auctions must be retained. *See* Hughes Petition for Clarification, or in the Alternative, Reconsideration, WC Docket No. 10-90 (filed Sept. 18, 2018); Opposition of Hughes Network Systems, LLC to Petition for Reconsideration by Viasat, Inc., WC Docket No. 10-90 (filed Nov. 7, 2018) at 3; Reply of Hughes Network Systems, LLC to Oppositions and Comments on Petitions for Reconsideration, WC Docket No. 10-90 (filed Nov. 19, 2018) at 8; *see also, e.g.,* Letter from Jennifer A. Manner, Hughes, to Marlene H. Dortch, FCC, WC Docket No. 10-90 (filed Dec. 7, 2018).

MOS Measurement Procedures
WC Docket No. 10-90

April 5, 2019

HUGHES®
An EchoStar Company

Overview

- Hughes supports the FCC revisiting the July 2018 Order on MOS testing score procedures for future Universal Service Funding opportunities. Hughes does not support the use of a revised standard for the recent CAF-II auction.
- In revisiting the MOS standard, the FCC's goals should be to:
  - Ensure that provider's broadband network segments deliver high quality connections to customer premises
  - Measurements should be repeatable and follow best practices in terms of evaluation, data collection, and interpretation
  - The approach should efficiently measure and monitor network performance and should not impose unreasonable administrative burdens on FCC staff or providers

Challenges with *in situ* P.800 Testing

- ITU Recommendation P.800 prescribes very detailed test procedures for measuring MOS
  - Environmental:
    - Test environment should be a sound proof cabinet with specific dimensions and acoustic characteristics.
  - Subject Selection:
    - Test subjects cannot be re-used for conversational tests within 12 months. This can make customer panel selection challenging.
    - Since the trial is not blind, customers come with bias as they have a business relationship with the provider – other forms of dissatisfaction may be expressed through a lower conversation opinion score.

Challenges with Laboratory-Based Testing

- Commercial providers of third-party conversation testing are not readily available as they were in the past.
- Laboratory testing is expensive, and by nature is fixed in location.
- For a satellite operator, accurately measuring the performance of each network segment requires testing within each spot beam.
- It is impractical to perform laboratory testing regularly in the number of locations necessary to accurately evaluate the service delivered to customers.

Characteristics of Conversation Quality

- The network characteristics which impact Conversation Quality are well defined.
  - CODEC selection and bitrate
  - Network Delay (Latency)
  - Variation in Network Delay (Jitter)
  - Packet Loss
- These characteristics are readily measurable, and Voice over IP service providers typically monitor them already.
- The ITU Recommendation G.107 defines an E-model, which allows for computation of predicted opinion scores based upon objective network and acoustic characteristics - the interaction of these factors is well understood.

Recommended Approach: Calibrated Subjective Testing with Objective Monitoring

- A combination of best practices will efficiently allow the monitoring of actual customer service levels, while reducing the complexity of testing and achieving FCC goals.
- Providers may perform fully compliant, ITU P.800 Conversational Testing, in a laboratory environment, while measuring those network characteristics that directly impact conversation quality, to establish a baseline.
  - This testing demonstrates that, to a blind panel of testers, the technology and network meets a MOS of 3.8.
  - Testing should be performed annually to certify the technology. Testing should also occur upon substantive changes to the network architecture (e.g., selection of a new CODEC or bitrate, or introduction of new Customer Premises Equipment)
- Providers can monitor those network characteristics – Latency, Jitter, and Packet Loss, and report regularly that the characteristics experienced by actual customer calls matches or exceeds those from the qualification tests, within a statistical bound.
- This hybrid approach allows valid use of the best practices documented in the ITU Recommendations, ensures that the FCC goals for call quality are met, reduces administrative brudens, and more accurately measures the experience of customers.